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FOREST INSECT SURVEYS, MODOC NATIONAL FOREST

1932

Including Eleventh Annual Report

on the Happy Camp-Lava Bed Area

by

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Berkeley, California
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FOREST INSECT SURVEYS, MODOC NATIONAL FOREST
1932

I
HAPPY CAMP-LAVA BED SURVEY
11TH ANNUAL REPORT

Summary of Findings and Recommendations

Increased losses indicated by the 1931 survey made in the fall of that year have been substantiated by the results of the 1932 survey. In addition, the trends of the 1931 season have been continued during the 1932 season; and at the present time epidemic infestations are to be found in the Glass Mountain, Timber Mountain, Badger and Happy Camp Units, and infestations of increasing yet sub-epidemic proportions exist in the other units of the area.

It seems probable that the area is now suffering from another epidemic cycle similar to that of 1925-1928. The infestations of 1931 and 1932 have many things in common, both in characteristics and volume of loss, with those of 1925 and 1926 respectively.

All indications seem to point to the fact that the epidemic has not yet reached its peak. For that reason it is felt that control work will save more timber per unit of cost this season than if it is attempted during the later phases of the epidemic. As a result, where values warrant it and there is a possibility of harvesting the timber within ten years, recommendations for control have been made. A summary of recommendations is as follows:

Glass Mountain Unit. No control. Values in the area that is heavily infested do not warrant other than salvage. This is recommended where possible.

Timber Mountain Unit. Same recommendations as for Glass Mountain Unit.

Badger Unit. Control of epidemic infestation recommended, due to presence of timber sale. Three plans described, although emphasis is placed on selection of entomological unit for control to prevent undue reinfestation, such as occurred on portions of the 1931 control area.

Lava Beds Unit. Control not recommended for this unit unless adjacent epidemic infestations in the Happy Camp Unit are controlled.

Happy Camp Unit. Control of epidemic infestations recommended if owners consider values sufficient and if harvesting of timber will be begun within a ten-year period.

Pit River Unit. Control recommended for subepidemic infestations purely from entomological standpoint. It is probable that values at stake and date of harvesting timber will not make this a practicable undertaking.

White Horse Unit. Timber in more heavily infested areas is to be harvested soon. Railroads have already been extended into infested area and no control is considered necessary.

Introduction

The annual survey by the Bureau of Entomology of the Happy Camp-Lava Bed area was completed during the period of October 7-22, 1932. The chief purpose of the work was to continue the study of the trends of the infestation in this area and to obtain reliable data upon which to base decisions concerning the necessity for control work. In addition, information was obtained that will form a basis for estimating the effectiveness of the cooperative control projects carried on by the Pickering Lumber Company and the U.S. Forest Service in the Badger Unit and the McCloud River Lumber Company and the U.S. Forest Service in the Lava Bed and White Horse Units during the winter and spring of 1931-32.

Methods and Costs

The regional survey crew of four men worked on the area and completed 100 per cent cruises of 17 plots or 5,160 acres. The location of these plots is shown in Fig. 1. In addition extensive reconnaissance surveys were made that traversed practically all the important timbered areas of the several units involved. The data obtained from the plots were used in interpreting conditions seen on the reconnaissance trips, and estimates were built up on the basis of information supplied by the two methods.

Costs of the survey, which were carried this year entirely by the Bureau of Entomology, were as follows:

Labor - - - - - - - -	$271.20
Expenses - - - - - - -	110.40
Total - -	$381.60

General Insect Conditions

Since the surveys were started, in 1921, the history of infestations in this area has been one of relatively heavy losses, including the completion of one entire and devastating epidemic cycle. A summary of losses for the entire area from 1921 to 1932 is given in Plate 7. At the termination of the 1931 survey it was believed that the area was about to suffer from another cycle of epidemic infestations. It is painful to report that in general the trends of 1931 have been continued by the 1932 broods and epidemic infestations exist in many parts of the Happy Camp-Lava Bed

area. There is little doubt that another cycle of epidemic infestations is now in progress. It remains to be seen if the present cycle will attain the intensity and duration or cause the losses of that of 1925-28.

The infestation this season is one in which heavy losses have been suffered in the timbered areas having the better site conditions. The fringes of timber and the more scattered and lighter stands in the vicinity of openings in the forest have suffered relatively low losses. Small groups and single infested trees are characteristic of the infestation, and general observations would seem to show that there was no marked selection of susceptible types of trees. Emergence of the summer broods of beetles was heavy, and winter broods are healthy, vigorous and extremely abundant in the bark of the infested trees. Attacks were occurring up to the time the work was completed (October 22), and at that time there was every evidence that the western pine beetle was building up in vigor and numbers rather than decreasing. No evidence was found that the predator population was large enough to be considered as a factor of importance in reducing the effectiveness of the western pine beetle population. Tree growth of 1931 and 1932 and general vigor of the stands, altho' better than in 1930, apparently is not sufficient to cause a depressing effect on bark beetle attacks.

Estimates of losses on the plots cruised in the fall of 1931 were in general lower than the actual losses that occurred. This may be considered typical of arbitrary estimates of a rapidly-rising infestation.

There is no certainty that the heavy losses suffered in certain areas during 1932 will continue during the 1933 season; but it is justifiable to predict that heavier losses will be caused by the summer broods of 1933, on the basis that the impetus of the infestation cannot subside until a large proportion of the immense bark beetle population now in the area has been absorbed or killed. This mortality can only be caused either by an improbable reduction of the 1932 winter brood, due to extremely high mortality between now and spring, or by a possible mortality accompanying attacks of the 1933 summer broods under unfavorable conditions. The former is an improbability, due to the vigorous and healthy condition in which the winter broods are to be found, and the latter is only a possibility.

Insect Losses by Units

Glass Mountain Unit

When this unit is considered as a whole, only about 16 per cent of the original stand of 1,210,000 M.B.M. on the unit in 1921 has been killed during the period 1921-1932. However, the unit has always been found to support two distinct types of infestation. One type, which is usually confined to an area of about 13,250 acres lying along the northern and eastern boundaries of the unit, has suffered a sustained and continuous loss during the entire period, and from two-thirds to three-fourths of the original

stand has succeumbed since 1921. The main portion of the unit, lying to the south and west of the above area, usually has suffered relatively light losses which, although fluctuating with the general trends of infestation in the Happy Camp-Lava Bed area, have been fairly constant. No marked invasion of this area by the infestation on the adjacent heavily-infested area has occurred during the past two years; in fact, the transition from the epidemic type of infestation has been abrupt.

Logging operations of the Long-Bell Company and the Shaw-Bertram Company have covered about 13,200 acres (shown in Fig. 1) to date. Practically no loss to speak of has occurred in the stands remaining on the cutover lands, except where these lie in the area described above as supporting a heavy infestation.

There is not enough timber remaining to be protected on the heavily-infested area of this unit to justify control measures other than those designed as salvage measures. It is possible that in the future there may be an extension of this heavily-infested area; but the present line of demarcation between the two types of infestation is abrupt, and recent infestations, although characteristically epidemic, have failed to invade the lightly-infested area.

Timber Mountain Unit

The stand on this small unit covers over 3,000 acres, of which only about 1,600 acres bears merchantable stands, chiefly because of fires and insect depredations. Previous losses recorded for this unit are as follows:

1921 - - -	1,300 M.B.M.
1922- - -	1,291
1923 - - -	1,000
1924- - -	1,500
1925 - - -	1,170
1926- - -	1,900
1927 - - -	3,150
1928- - - -	450
1929 - - -	400
1930- - - -	210
	12,371 M.B.M.

The total loss for this ten-year period amounts to about 53% of the stand originally on the area in 1921.

In 1931 and 1932 an additional 2,608 M.B.M. of timber is estimated to have been killed, which is an additional 11%, or a total of about 64% of the original stand killed since 1921. The 1931 infestation, which in the spring of that year was estimated as causing the loss of only 210 M.B.M., actually killed 860 M.B.M. This brought up the infestation to a true epidemic status which has continued and increased, causing a loss estimated at more than double that of 1931 in 1932 and killing about 18.5% of the residual stand.

The past history of the unit shows that losses have been extremely high in years when epidemic conditionswere found in other portions of the Happy Camp-Lava Bed area, and heavier than endemic losses occurred during several years of endemic infestations. Undoubtedly environmental factors influencing the insects and host trees have been responsible for these unusually heavy losses of the past. There is no reason to forecast a future that will be different.

No recommendations are made, as it is considered that the unit is too small and the stand too depleted to warrant control other than salvage. Unless steps are taken to harvest the remaining stand it is doubtful if much of the present crop will be utilized as green logs or timber.

Badger Unit

The nine half-section plots cruised in this unit form the basis for estimates of 1932 losses, and provide as well a means of judging the effectiveness of the Pickering control operations in 1931.

The infestations of past years have taken considerable toll of the pure ponderosa pine stands in this unit. The unit, which covers about 88,000 acres and bore an original stand of about 14,000 b.m. per acre (J.R. Berry and B.O. Hughes, Report on Western Pine Beetle Situation and Appraisal of Timber Values in the Badger Springs Unit, Modoc National Forest, 1928) in the better-timbered areas, or a total estimated stand of about $80,000 M.B.M., suffered losses from 1921 to 1930 inclusive as follows:

1921 - - -	11,140 M.B.M.
1922- - - -	6,421
1923 - - - -	3,080
1924- - - -	4,710
1925 - - -	12,240
1926- - - -	28,350
1927 - - -	89,600
1928- - - -	60,400
1929 - - - -	6,140
1930- - - -	6,960

Thus, during the period of 1921-1930, a total of 229,041 M.B.M. was infested by insects, a loss of about 26% of the stand occurred, and destruction of timber to the value of about $687,220 was suffered if stumpage is considered worth $3.00 per M.B.M.

In 1931 it was evident that another epidemic cycle of infestation was beginning, and subsequent work has confirmed this. The residue of the stand, about 660,000 M.B.M., on the unit suffered a loss during that year of about 2.45%, or 16,170 M.B.M. All information collected during the 1932 cruise points to a continuance of the epidemic conditions of 1931, with marked increases in the 1932 losses. Estimates for 1932 indicate losses estimated at about

24,480 M.B.M., or 3.8% of the stand remaining at the end of the 1931 season. Thus, by the end of the 1932 season over 30% of the stand originally on the area in 1921 will have been destroyed by insects.

In the past the area has suffered from similar infestations that have run their course in about four years. It is possible that the present epidemic infestations will continue as epidemic for several years. In such an event, with over 30% of the original stand already destroyed, such a cycle and its attendant losses would reduce values to a point where the margin between profit and loss in harvesting the timber would be slight.

There are three definite zones of infestation in the Badger Unit. The largest zone, on which losses run from 4 to 5% of the residual stand, includes practically all the unit except those portions treated during the winter of 1931 in the Pickering Control Project, the results of which will be discussed in a supplementary memorandum. The second zone, which has an infestation of from 3 to 4% of the residual stand now present on the area, lies in the northeastern portion of the control area. It is an area in which a less satisfactory retardation of epidemic tendencies was secured. The third zone includes the greater portion of the controlled area, including for the most part the central portion of the area, in which the infestation was held to about the level of the 1931 infestation and in which reinfestation from outside areas did not occur. These zones are indicated on the map accompanying this report.

Conditions of infestation in all three zones are unstable, for factors favoring epidemic tendencies are operative throughout the entire Badger Unit. For this reason the following recommendations are suggested. They are offered under four different plans to meet the pressure of economic conditions, should these and not entomological considerations be the deciding factors in determining the course of action to be followed this season.

Plan 1. Maintenance control of area treated in 1931

Acreage - 19,680
Est.no.trees to be treated - 3,100
" volume - 2,945 M.B.M.
" cost - $11,780
Ownership and liabilities:
U.S.- - - - - - - -12,160 A. - $7,303.60
Pickering Lbr.Co.- 7,520 " - - 4,476.40

This plan would have the following advantages:

a. It would to some extent protect the savings already secured by the 1931 control operation;

b. It would counteract the effects of the factors operating to bring about epidemic conditions.

This plan would have the following disadvantages:

a. The area, surrounded on all sides by heavy epidemic infestation, is of insufficient size to protect adequately the timber within it under conditions of epidemic infestation. Reinfestation, particularly along the western boundary, has already occurred in a belt about a mile in width;

b. The area is not a unit when considered from an entomological standpoint, and even when considerably enlarged, as suggested in 1931--when it was desired merely to reduce the losses in the more heavily infested areas and prevent the building-up of the infestation--would be of insufficient size to combat the present infestation if natural barriers were not used for boundaries.

Although the following plan (Plan 2) includes an area that might be considered too extensive and too expensive an undertaking, some measure of protection and relief could be secured by following Plan 1, and in addition treating as large a surrounding area as available funds would permit. Particular attention, however, should be paid in this event to the treating of the Red River block of timber west of the area treated in 1931; for this area, in connection with natural epidemic tendencies, has been the greatest source of reinfestation.

Plan 2. Maintenance control of area treated in 1931 and treatment of a sufficiently enlarged supplementary area to insure protection.

Acreage - 53,700
Est.no.trees to be treated - 12,450
" volume - 11,827 M.B.M.
" cost - $47,000
Ownership and liabilities:

U.S. - - - - - - - - -	29,780 A. -	$26,038.00
Pickering Lbr.Co. - -	18,360 " -	16,967.00
Red River " -	4,120 " -	3,619.00
Misc. owners - - - -	440 " -	376.00

This plan would have the following advantages:

a. It would provide for retention of values already saved in the 1931 control area;

b. It would provide protection for that area and prevent further reinfestation;

c. It would combat the heavy epidemic infestation in the surrounding areas and retard subsequent heavy losses;

d. It would have natural entomological boundaries except along the southern boundary.

This plan would have the following disadvantages:

a. It would ignore the heavy losses and epidemic infestation existent in lands to the south and west of the area selected;
b. It would not prevent reinfestation from untreated areas to the south and west.

Plan 3. Control of the Badger Unit.

Acreage - 88,060 A.
Est.no.trees to be treated - 15,450
" volume - 14,670 MBM
" cost - $58,680
Ownership and liabilities:

U.S.	41,220 A.	$27,470
Pickering Lbr.Co.	40,920 "	27,220
Red River "	4,280 "	3,725
Misc. Owners	1,640 "	1,115

This plan would have the following advantages:

a. It would combat the epidemic infestations in all parts of the unit, which would mean practically all parts of the sale area;
b. It would have boundaries sufficiently protected from reinfestation.

This plan would have the following disadvantage;

a. It would be an extremely large project.

Plan 4. Do no control work.

This plan would sacrifice present values and rely on the fact that the present epidemic might stop before the values represented by the stand are reduced below the merchantable level. This action would be a gamble and is not based on the facts of the past history of the area.

Lava Bed Unit

A summary of losses in the unit during the ten-year period of 1921-30 is as follows:

1921	7,160 MBM
1922	4,800
1923	3,280
1924	4,420
1925	9,250
1926	12,600
1927	14,000
1928	8,650
1929	5,280
1930	3,140
Total	72,580 MBM

With a total estimated stand of about 700,000 M.B.M. on the area in 1921, a total of slightly over 13% has been killed in the ten-year period. Losses in 1931 are estimated to have been 1.53% of the residual stand, or 13,560 trees having a volume of 9,492 M.B.M. In 1932 the estimates are 16,950 trees having a volume of 12,712 M.B.M., or 2.06% of the residual stand.

The White Horse control project area of about 19 sections in the southwestern portion of the unit is the only portion in which 1932 losses are estimated to be lower than those of 1931. In the eastern portion of the unit--that part adjoining the epidemic center of infestation in the Happy Camp Unit--considerable increase is evident and there are numerous small groups of infested trees attesting the influences of the adjacent epidemic. A typical group is illustrated by Plate 1. The effects of these influences on the infestation of the Lava Bed Unit become less and less evident to the north and west.

It is noteworthy that, although increases were noted in 1931 and a further increase in losses is expected to result from the 1932 infestation, the greater portion of the loss is not considered the result of increased activity within the unit, but of the influx of insects from the adjacent infestation centers.

Judging from present indications, it is probable that the influx of beetles from outside the unit will continue. Whether or not this will result in an extension of the epidemic area of the Happy Camp Unit remains to be seen. It is patent, however, that no action taken to control the increases in the Lava Beds will be effective unless the infestation in the Happy Camp Unit is also controlled.

The area controlled in 1931 now has a nearly endemic infestation. If factors favoring epidemic infestations continue it is probable that, although the stand in this unit is considered relatively less susceptible than that in other units, a reinfestation will occur after recovery from the effects of the control work.

Happy Camp Unit

Past losses in this unit have been as follows:

1921 - - - -	9,420 M.B.M.
1922- - - -	-7,067
1923 - - - -	3,180
1924- - - -	-9,220
1925 - - -	-11,280
1926- - - -	28,400
1927 - - -	-28,000
1928- - - -	20,100
1929 - - - -	8,930
1930- - - -	7,130
Total	132,727 M.B.M.

With a total estimated stand of 1,308,300 M B.M. on this unit in 1921 the loss for the ten-year period is but little over 10% of the original stand. During the epidemic period of 1924-28 it was considered that the group losses of 1927 and 1928 were the results of invasion from surrounding areas. The fact that a grouping of infested trees (see Plate 2) is taking place in the unit and that the wave of infestation, instead of extending from outside the unit into its territory, is apparently originating within the unit and spreading out to other areas, would seem to indicate that the infestation is acting independently of those in surrounding units and forms another center of danger to the surrounding stands. 1931 losses in this unit are estimated at 15,547 M.B.M. or 1.15%, and those of 1932 at 27,017 M.B.M. or 2.32% of the residual stand.

The 1932 infestation is causing heavy losses in the area east of the lava beds and from Sugar Pine Ridge on the south to Mud Spring on the north. This area of heavy infestation extends eastward to a lava bench running south and north that divides the unit into two parts. There is a sudden and noticeable decrease in the losses on this bench, but this condition affects only a belt of timber about a mile or a mile and a half in width that parallels the lava bench. East of this belt the infestation progressively becomes worse and distinct epidemic conditions exist, as they do in the center of infestation to the west. In the southern portion of the unit, particularly in the open stands surrounding and to the east of Egg Lake, light losses were caused by insect activity in 1932.

The disconcerting features of the infestation in this unit this year are that the losses of over 2% are to be found in the stands of better-quality timber and on the better sites. In addition, the fact that it is certain epidemic conditions are arising in centers in this type of timber and not spreading into those areas from centers in poorer timber in which the insect population has been allowed to increase makes one wonder if the future of this unit will be similar to the past of the Badger Unit.

Losses in this unit are high enough; the infestation exhibits the characteristics of a vigorous and epidemic type of attack, and the values at stake are large enough to warrant the recommendation of control from an entomological standpoint for those areas in which the losses are over 2% of the stand. However, apparently there is little possibility that the timber in this unit will be harvested for some time. For this reason these recommendations are not pressed, as the necessary maintenance control required to maintain and protect the savings effected by an efficient control project would eventually reduce a possible profit to a loss. If the various owners decide that they shall realize on this timber within ten years then it is for them to decide and weigh the savings effected by control against the possibility of the infestation not continuing its normal epidemic cycle or subsiding before a sufficient amount of timber is killed to cut into the profit of a logging operation. If control is considered it must be remembered that only

a large operation will prove effective, as there are no entomological boundaries to prevent the spread of the insects from the uncontrolled to the controlled areas.

Pit River Unit

The record of losses in this unit for the ten-year period of 1921-1930 inclusive is as follows:

1921 - - - -	3,040 M.B.M.
1922- - - -	-3,604
1923 - - - -	1,620
1924- - - -	-1,970
1925 - - - -	3,120
1926- - - -	-7,350
1927 - - -	-10,150
1928- - - -	7,000
1929 - - - -	4,000
1930- - - -	-2,400
Total	-44,254 M.B.M.

The original stand in this unit has been given as in the neighborhood of 310,000 M.B.M., which indicates a loss of about 14.4% of the total stand in the ten-year period.

The unit contains a very uneven type of stand. Much of the area bears a distinctly fringe type in which Jeffrey pine appears. Sagebrush flats are common in other parts of the unit and the stands surrounding these are characteristically open with considerable reproduction and material of less than merchantable size. In addition pockets of better-quality timber are to be found in the unit. Neither of the last two types of stands ~~are~~ is normally heavily infested and the low per-acre volume of the fringe type has led to relatively low-volume losses in the past.

In 1930 and 1931 the more apparent losses were in the fringe type. In 1932, however, the intensity of infestation in that type does not appear to have increased greatly. Losses in the better-type timber, however, show abnormal increases that can be considered subepidemic in amount of timber lost, but have the characteristics of a vigorous epidemic infestation. The open stands surrounding the flats appear to be relatively unaffected by the conditions that have led to the abnormal infestations in other parts of the same unit. Estimated losses in this unit for 1931 were 2,340 M.B.M. or 0.87% of the residual stand, while in 1932 nearly twice that amount (4,511 M.B.M. or 1.7% of the residual stand) has been killed.

It is probable that the increase of insect activity represented by the estimated losses given above is an indication of epidemic tendencies as applied to this unit. It is impossible to forecast definitely a protracted period of epidemic infestations, altho' past experience would indicate that such a period is possible. However, it seems inadvisable to consider control for the unit or those portions that are more heavily infested or show epidemic tendencies;

The fact that it is doubtful if the timber will be harvested in the near future would make control recommendations a contrast to established control policy; although with increased market values or with an active logging operation established in the general vicinity the present conditions of infestation would be sufficient to prompt the consideration of control recommendations.

White Horse Unit

Infestations in this unit during the ten-year period of 1921-1930 destroyed about 86,852 M.B.M., or only 6.5% of the stand estimated to have been on the area in 1921. In 1931 8,465 M.B.M. or 0.82% and in 1932 15,810 M.B.M. or 1.26% of the residual stand was killed. The sudden increase of losses during the past two years is apparently general where ponderosa pine is an important species in the stand, but increases were much more in evidence in the northeastern portion of the unit than in the Big Valley Mountains. The south exposures of these mountains, which bear a more or less fringe type of stand as exemplified by that near Wiley Ranch, have suffered less during 1932 than in 1931. The north exposures of the mountains contain stands in which ponderosa pine is a less important species and thus losses are somewhat lighter.

The increase of cutover areas in the unit has resulted in the fact that the greater portion of the relatively susceptible yet more valuable timbered areas of the unit are now cutover. With the completion of logging in the northeastern portion of the unit, fringe type or relatively unsusceptible mixed conifer stands in which fir predominates will comprise the greater portion of the uncut stands remaining.

Logging operations have now been extended into the area in which the heaviest infestation occurs. There is little need of considering any further control measures for this unit this season.

II
NORTH WARNER SURVEY

Summary of Findings and Recommendations and Introduction

Control is advisable in both units covered by the North Warner survey when conditions are considered from an entomological standpoint alone. The quantitative results of the survey plot in the Buck Creek Unit provide sufficient reliable data upon which to base this recommendation, but the reconnaissance cruise of the Sugar Hill Unit supplies only information of a qualitative nature that must be considered a less reliable basis.

The many problems and factors that must be considered and weighed in making a decision concerning control--management problems, determination of values, future use and alternative plans involving salvage--cannot be passed on by an entomologist alone, but are the province of the administrators of the areas involved. This is particularly true of these areas, in which the entomological possibilities are known to the entomologist, but the economic factors are relatively unknown.

The presence of an epidemic infestation on Regional Survey Plot #11, cruised in the fall of 1932, resulted in a reconnaissance survey of the Buck Creek Unit and of the Bandango Valley, Lassen Creek and Sugar Hill areas of the Sugar Hill Unit. The marked changes in infestation that have occurred in these areas during the past season are worthy of note in that they concern relatively small and isolated bodies of timber, yet they agree closely with similar changes thirty to fifty miles to the southwest in the main body of the Happy Camp-Lava Bed area. Changes in infestation along the northern boundaries of the Lassen National Forest, over 75 miles distant, are also closely allied to those in the North Warners--a fact of significance in indicating the fundamental nature and widespread effect of the factors causing the changes.

The areas included in this report have not been included in previous reports of a similar nature, although one plot in the area has been cruised for several years. It is thought advisable, however, to give what information is available concerning them, as the timber concerned is accessible and of considerable value.

Buck Creek Unit

This area, containing about 2,250 acres, of which less than half is considered ponderosa pine type, is an isolated timber body lying in the upper basins of several small creeks tributary to Willow Creek in the North Warner Mountains. The boundaries of the unit are shown in Fig. 2. The legal land divisions included in the unit are parts of or the entire area of Secs. 31, 32 and 33 in T 47 N, R 15 E, and Secs. 4,5,6,7,8 and 9, T 46 N, R 15 E. The timber is of good Site-III quality in the basins, but a considerable portion of the timber at the lower altitudes is on rocky slopes with southern exposures, and is of a much poorer quality.

Infestation

Regional Survey Plot #11 (320 acres) is located in this unit, and results of surveys of the past three seasons are as follows:

Year	Vol. M.B.M. on Plot	Losses		% Stand
		Trees	Volume	
1930	4,529.8	33	32,690	0.72
1931		83	81,790	1.82
1932		199	207,000	4.69

The above figures, when applied to the unit, result in the following estimates of 1932 losses:

No.Trees	Volume
600	624,000 B.M.

The losses have increased considerably during the past three years. The infestation is now epidemic, and groups containing up to 14 trees are common. The heavy losses are not, as would be expected, confined to the poorer-quality stands. A large proportion of infested trees are to be found in the better-type timber along the creeks and in the basins. Plate 3 illustrates the type of infestation caused by the 1932 broods and gives some idea of the quality of timber affected.

In addition to losses in ponderosa pine, relatively heavy losses in white fir have occurred during the past few years. Incense cedar reproduction and pole stands along the creeks are also dying. On first examination this loss (illustrated by Plate 4) was believed due to drought; but later examinations revealed that the infested trees grew near a stream that runs until late summer, and that the infestation by Phloeosinus fulgens Sw. appeared to be primary rather than secondary.

Recommendations

Entomologically, the infestation is of sufficient importance to warrant control. In fact, if sufficient data had been available in 1931 upon which to base recommendations, it is probable that control in the winter of 1931-32 would have paid better than control in 1932-33. There are no means available for forecasting the future of the present epidemic, but all indications force the conclusion that it has not yet reached its peak.

Final decision concerning control for the winter of 1932-33 will have to be based on the values at stake and the possibility of realizing on those values.

It is estimated that 400 trees with a volume of 486,000 B.M. will have to be treated at a probable cost of about $2,000. If this timber is to be harvested within a five- or ten-year period and if stumpage values will be $3 or higher, it is recommended that control be attempted this winter. The necessity for maintenance control in succeeding years will depend on subsequent developments.

Sugar Hill Unit

This unit contains about 18,000 acres, the stand on about 8,000 acres of which was destroyed or damaged by the Sugar Hill Fire of 1929. About 3,175 acres are cutover. The timber is of good Site-III quality, and extends from the type boundary along Goose Lake to the fir type at the higher elevations to the east. The boundaries of the unit are shown on the accompanying map (Fig. 2). A considerable part of the stand is mixed-conifer in which ponderosa pine is an important species, but at the lower altitudinal levels the stand is pure ponderosa pine. On north slopes nearly pure stands of fir occur, or fir and ponderosa pine.

Infestation

No plot cruises have been made in this unit, and estimates must be based on a comparison with conditions as they were found in the Buck Creek Unit.

Observations indicated a noticeable increase in recent infestations. Numerous small and medium-sized groups of ponderosa pine infested in 1932 were appearing, and many single infested trees were scattered through the unit. Plate 5 illustrates the infestation in this area.

There is no doubt, judging from the marked indications, that the western pine beetle is more active on this area this season than it has been for some time. It cannot be considered, however, that true epidemic conditions now obtain, although with continuance of the present trends they will probably appear in 1933.

Extremely rough estimates of 1932 losses for approximately 13 sections not included in the Sugar Hill fire and excluding fir type are as follows:

No. Trees - - - - - 1,925
Volume- -- - - - - -2,310,000 B.M.
Est. Cost of Control - $5,500

In addition to the general infestation of western pine beetle in ponderosa pine, the mountain pine beetle was noted as active in thick pole stands of ponderosa pine and white fir. Several acres have already been changed to a pure fir pole stand, due to the activities of these beetles, and the area is rapidly enlarging. A similar type of infestation was reported for the same general region by Keen in 1922. Losses in white fir, due to attacks by Scolytus subscaber, are heavy in this unit. Plate 6 illustrates this loss.

Although the infestation in this unit has increased markedly during the past season and shows every indication of continuing that increase. It has been the Bureau's belief, substantiated by recent control operations, that the time to control epidemics is at the start of the cycle. All indications point to the fact that this area is in the incipient epidemic stage with subepidemic losses, and

it is felt that if funds are available, timber of considerable value could be saved by their expenditure on this unit. The fact that three logging operations are present in the unit and that the timber will probably be harvested in the not-too-distant future is a factor that would also add to the profit of a control operation.

The presence of the three logging operations in the vicinity prompts the suggestion that their equipment and facilities be utilized if possible in forwarding some sort of a salvage plan. This would not perform the complete functions of a control operation, but would probably aid to some extent and would reduce the future loss in proportion to the amount of area covered and the efficiency of the work.

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III

NOTES ON OTHER AREAS

Infestation in the Big Valley Mountains west of Bieber has in general followed the trends of the Happy Camp-Lava Bed area. The eastern slopes, which carry the better-type timber, have suffered from marked increases during 1932, and epidemic conditions of infestation are approached. Although the infestation remains active on the western slopes, which bear a fringe type of stand, the 1932 infestation is considered somewhat lighter than that of 1931. The greater portion of the area is privately owned.

The mountains east of Adin also bear stands on which the infestation has been reduced to some extent in the fringe type, but has increased measurably on the better sites. These observations indicate the trends of the Happy Camp-Lava Bed region are being followed in this area.

IV
PRELIMINARY RESULTS OF THE PICKERING CONTROL PROJECT OF 1931-32

The Badger Unit, which has been subjected to heavy insect-caused losses since records were started in 1921, has been the scene of two forest insect control projects. The first, which was carried on against a subsiding epidemic that had passed its peak, was reported on by Keen in 1929[1,2]. The second was directed against an epidemic in its first stages. Not only is it possible to estimate the effects of these control operations in terms of timber saved due to a reduction of losses, but it is also possible to make a comparison of the effectiveness of control operations conducted at the two different stages of an epidemic and judge their relative worth.

Although the two control operations embraced some common area they had different boundaries, as shown in Fig. 1. No attempt will be made to rely on general estimates of the conditions obtaining before and after control. Instead information from a series of plots that have been cruised both before and after the control operations will be used as a basis and their results applied mechanically to the entire control areas. In this way it is believed changes that can be attributed to the control will be more accurately expressed than if, in the estimates of the total gains or losses, an attempt is made to temper plot results or to make allowances for inequalities that have been found in the intensity of infestation.

1928-1929 Control

Area	17,360 A.
U.S. Forest Service	8,520 A.
Pickering Lbr. Co.	8,840 "
Trees treated	2,728
Volume "	2,495,514
Cost per M.B.M.	$4.56
" of operation	$11,379.54

1931-1932 Control

Area	19,680 A.
U.S. Forest Service	12,160 A.
Pickering Lbr. Co.	7,520 "
Trees treated	1,932
Volume "	2,344,950
Cost per M.B.M.	$4.04
" of operation	$9,478.09

[1]Keen, F.P. Report of insect control work carried out by Pickering Lumber Company on the Badger Sale Area, Modoc National Forest, Calif., during season of 1928-29. File Typescript. August 1929.

[2]Keen, F.P. Western pine beetle survey, Happy Camp-Lava Bed area, Modoc Nat. Forest, Calif. Eighth Annual Survey Report, December 1929. File Typescript.

1928-29

Two methods of treating were used in this operation--the ordinary felling and burning method and one in which the trees were logged and the infested portions burned. As the felling and burning method was the only one used in 1931-32, the figures for the operation of 1928-29 have been changed to apply to the entire operation and costs have been changed to apply to the trees treated by both methods, using the average cost ofthat portion treated by felling and burning as a basis.[1]

Results

The following table lists the plots cruised to check the results of the control operations. The figures given under 1929 and 1932 are expressions in per cent of the relation of the infestation in the year following control to that in the year in which the control was done. All plots contain 320 acres.

Plots in Controlled Area

Plot Location	% Reinfestation 1929	1932
W½ Sec. 10, T 43 N, R 8 E	14.83	150.35
N½ " 35, T 44 N, R 8 E	12.41	127.26
N½ " 29, T 44 N, R 8 E	16.67	118.96
N½ " 30, T 44 N, R 8 E	15.49	212.32
W½ " 16, T 44 N, R 8 E	-----	40.13

Plots in Uncontrolled Area

W½ " 16, T 44 N, R 8 E	9.00	-----
S½ " 22, T 43 N, R 7 E	38.08	116.31
S½ " 13, T 44 N, R 8 E	-----	197.00
N½ " 25, T 44 N, R 7 E	23.65	256.53
N½ " 26, T 44 N, R 7 E	22.16	263.35

In 1929 the controlled plots showed an average decrease to 14.85% (volume basis) of the infestation of 1928, while the plots in the uncontrolled area showed a decrease to 23.23%, a difference of 8.38 in favor of control. In 1932 the plots on the controlled area showed an average increase over 1931 of 29.80% as compared with an increase of 108.27% on the uncontrolled plots. This shows a difference of 78.47% in favor of the controlled plots.

Basing our calculations on cruised losses on the plots, and checking tree and volume losses on controlled plots against those on uncontrolled plots, we find that if we assume infestations in the controlled plots would have followed the same trends as did those on the uncontrolled plots the following savings were secured by the control operations:

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[1]The foregoing figures are taken from "Report on Badger Unit Insect Control Project, 1931-32," by E. Buck and A.L. Parker, March 1932.

Estimated Average Savings on Plots

	Trees	Volume
1928-29	20	19,555
1931-32	88	64,354

Applying these figures to the entire control unit we find the following savings were secured:

1928-29	1085	1,060,858
1931-32	5412	3,957,800

Discussion

In 1929 the natural trend was downward and the controlled plots showed that in addition to the natural decrease in losses an additional decrease was secured. In 1931 and 1932 the natural tendencies were for increases to occur, results on some plots showing these increases to be as high as 163.35% of the 1931 losses. On the controlled plots, with one exception, this natural upward trend was not entirely overcome but was much less than that found on the uncontrolled plots. In the case of the plot in Sec. 30, T 44 N, R 8 E, in which an increase of 112.32% of the 1931 infestation was found, this exceptionally high loss can be accounted for by the fact that the plot lies next to the boundary of the controlled area and in addition is adjacent to an uncontrolled area suffering from exceptionally heavy losses. This uncontrolled area, of which the results given for the plots in Secs. 25 and 26, T 44 N, R 7 E are examples, has caused considerable reinfestation of the controlled area. The inclusion of the infestation in Sec. 30, however, as well as that represented by the several other plots within the controlled area, insures that an average of conditions has been secured--an average that we believe from observation may be higher than is actually the case. In other words, the figures secured by the mechanical application of plot results we feel does not overstate the benefits of the control work, but on the other hand apparently underestimate them.

The above figures concerning values saved by control do not and cannot take into consideration the probable effects of the control on subsequent infestations of the same epidemic cycle. It is probable that, in increasing infestations at least, these effects may result in the saving of considerable timber not indicated in the findings expressed in this memorandum. In addition, the reduction of fire hazards due to the removal of snags may make losses encountered in a control operation void, due to the savings that might result during a single fire in the area.

No attempt was made in the 1931-32 control operation to treat flathead trees or trees containing some brood but considered no menace if left. Although a substantial reduction in losses was secured by the operation, the question as to whether or not greater reductions would have been secured had these trees been treated

will remain a live issue. We are inclined to believe, in view of the relationships existing between western pine beetle attack and flathead borer attack in this area, that many of the trees rejected for control may have carried sufficient bark beetle broods to provide considerable material for reinfestation. It is suggested in future control operations in this type of forest and infestation that flathead trees be included in the operation.

The control area was not an entomological unit but was chosen arbitrarily due in part to the fact that the infestation was not considered to have reached an epidemic status, and in part to the limitation on funds available as a result of depressed economic conditions. This is responsible for a considerable portion of the reinfestation. The results indicate the definite advantage of securing an entomological unit for a control operation so that the natural boundaries will prevent reinfestation due to the drifting in of a new population from adjacent uncontrolled areas.

Conclusions

Four definite conclusions may be drawn from these two control operations. The first substantiates our belief that the best time to strike at infestations is at the beginning of an epidemic cycle. The second is that more care should be used in recommending control operations so that they will not be directed against subsiding infestations. The third conclusion is that entomological units should be selected where possible in order to prevent undue reinfestation not caused by natural increases within the area. The fourth is that more emphasis should be placed and more time and money spent in finding definite indicators of epidemic cycles before they have started in extending the areas covered by surveys, so that an accurate knowledge of the status of infestations in them may be available and in improving methods of control in order to reduce costs.

V

PRELIMINARY REPORT ON THE WHITE HORSE CONTROL PROJECT OF 1932

The infestation in T 41 N, Rs 4 and 5 E that was included in the White Horse Control Project of 1932 involving about 9,260 acres, was not considered epidemic in 1931 when arrangements were made for the project. It was noticeable at that time, however, that the heavier losses were occurring in the stands of better-quality timber and was apparent that the infestation was much lighter in the Lava Bed area.

The work done on this project by the McCloud River Lumber Company and the U.S. Forest Service has been reported by Parker and VanDewalker[1] as follows:

Acres treated
McCloud R.Lbr.Co. - - 5,440
U.S.Forest Service - -6,700
Total - -12,140
Trees treated- - - - - 1,027
Volume " - - - 1,454,280
Total Cost - - - $3,950.00

[1] Parker,A.L.and VanDewalker,C.A.,White Horse Insect Control Project, May, 1932,

~~Plot results~~

The only plot that has been cruised within the control area is one located in Sec. 19, T 41 N, R 5 E. As checks against this plot one in Sec. 12, T 40 N, R 5 E, and another in Sec. 18, T 42 N, R 6 E, may be used, although it is at once evident that they are in different timber types and that their trends may not be applicable.

Plot	1931		1932		
Controlled	Trees	Volume	Trees	Volume	% of 1931 Inf.
N½ Sec.19,T 41 N,R 5 E	78	65,550	30	20,340	31.03
Uncontrolled					
E½ Sec.12,T 40 N,R 5 E	88	88,560	113	181,500	204.95[2]
E½ " 18,T 41 N,R 6 E	52	66,140	171	183,270	277.01
Averages of Uncontrolled Plots	70	77,350	142	182,385	240,98

Discussion

The above data are insufficient to form a basis for reliable estimates. They do show, however, that the sample taken in the controlled area has not followed the upward trend of uncontrolled areas and observation substantiates this reversal of trends for practically the entire control area.

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[2] A few trees apparently treated last winter were found in this plot. It is not known to us that this area was controlled by the company, but if any control was practised it was partial and ineffective, as indicated by the large number of winter brood trees of 1931 standing and the lack of effect.

Merely for the purpose of indicating to some extent the probable values saved by the control operation we may consider the results from the control plot to be average, although control operations on that area last winter showed the infestation to be slightly below the average for the controlled area. It is improbable, in view of the marked increases that are general through the Happy Camp-Lava Bed area this season, that no increases would have been found on the area in 1932 if no control had occurred. However, if we allow for no increases and consider the infestation would have killed the same amount of timber in 1932 as it did in 1931, the difference between that amount and the amount actually killed, as indicated bythe plot, would be 1824 trees and 1718 M.B.M. This may be considered the minimum saving effected. The maximum saving may be considered as about 6,000 trees and 5,230 M.B.M. The actual savings probably lie between these two extremes.

TABLE 1

Estimated Losses 1930-1932
Happy Camp-Lava Bed Area, Modoc National Forest

Unit	Acres[1]	Volume MBM[5]	1930			1931			1932		
			Trees	Vol MBM	% St.	Trees	Vol MBM	% St.	Trees	Vol. MBM	% St.
Glass Mt.	63,800[2]	905,246	10,500	7,876	0.87	41,870	25,126	2.80	36,300	21,806	2.50
Timber Mt.	3,280[3]	11,000	840	210	1.91	2,530	860	7.96	5,770	1,848	18.50
Badger	88,060	666,700	8,200	6,960	1.04	18,370	16,170	2.45	25,780	24,480	3.80
Happy Camp	66,500	1,185,000	7,500	7,130	0.60	13,220	13,547	1.15	28,440	27,017	2.32
Lava Beds	72,300	629,000	3,900	3,140	0.50	13,560	9,492	1.52	16,950	12,712	2.06
Pit River	33,000	270,000	3,200	2,400	0.88	3,120	2,340	0.87	7,060	4,511	1.70
White Horse	55,800[4]	1,041,290	2,080	3,664	0.35	9,240	10,164	0.98	9,880	15,810	1.26
	382,740	4,708,236	36,220	31,380		101,910	77,699		130,180	108,184	

1 Planimetered 1932
2 13,200 acres cutover lands not included
3 Actual lumbered acreage about 1600
4 12,180 acres cutover lands not included
5 All volumes corrected to 1930; cutover lands not included in estimates

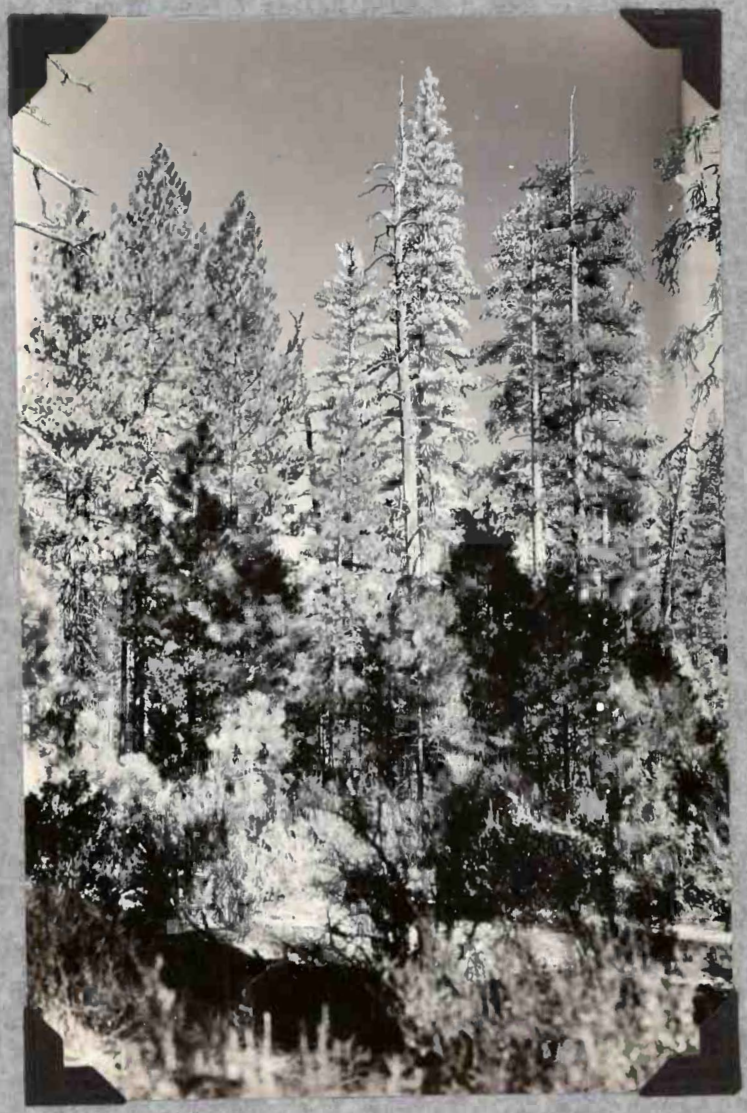


Plate 1

Group of five 1932 western pine beetle brood trees in Lava Bed Unit. This group is typical of the infestation in this unit. The infested trees, which at the time the photograph was taken were in the sorrel stage, may be distinguished by their lighter color, due to the use of panchromatic film and light filters. (7553a)

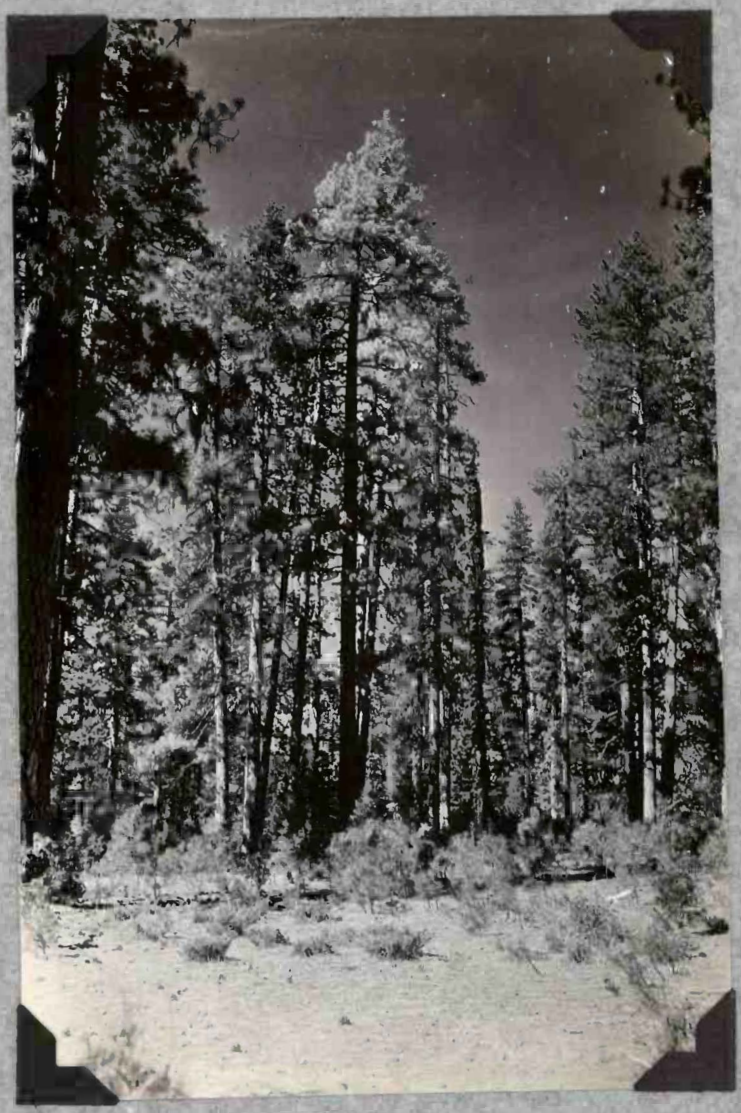


Plate 2

Group of seven 1932 brood trees cruised on R.S.3 near Happy Camp. Several of the trees in this group had not faded. Attacks on the green trees were successful. This group is typical of those found in the better-type timber in the Happy Camp Unit.

(7553d)

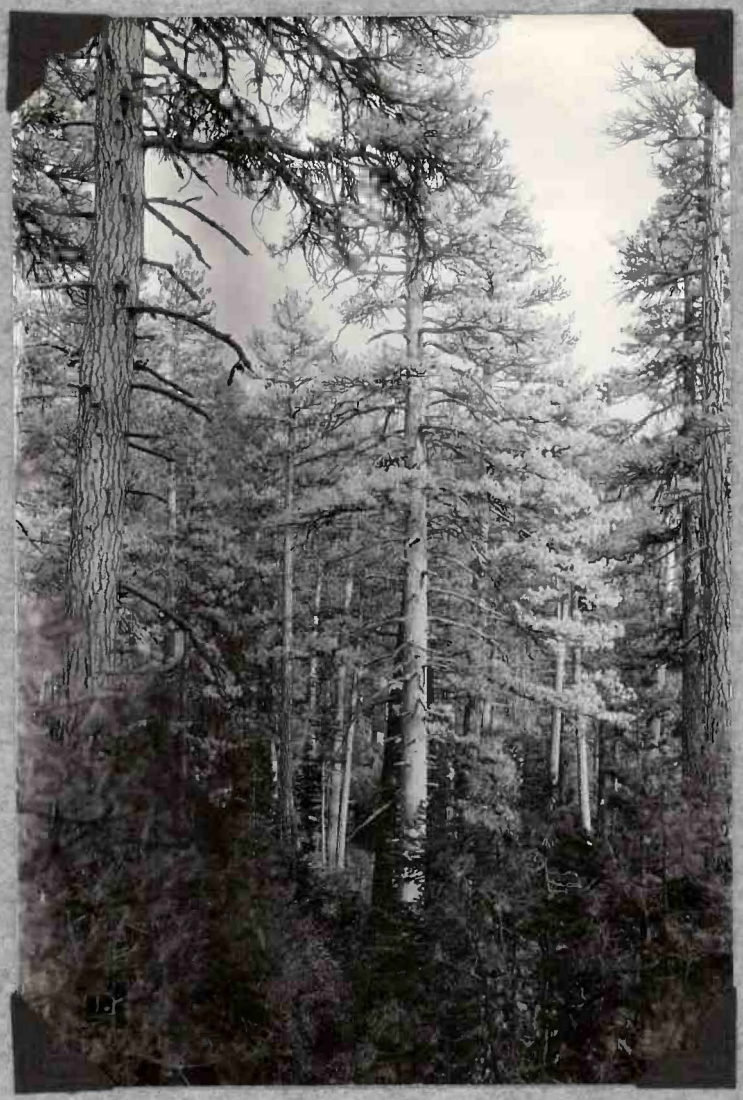


Plate 3

Illustrating injury to the better-type timber in the Buck Creek Unit. Practically all trees in this photograph have succumbed to attacks of 1932 broods of western pine beetle, and only a portion of the entire group is included in the picture. (7493a)

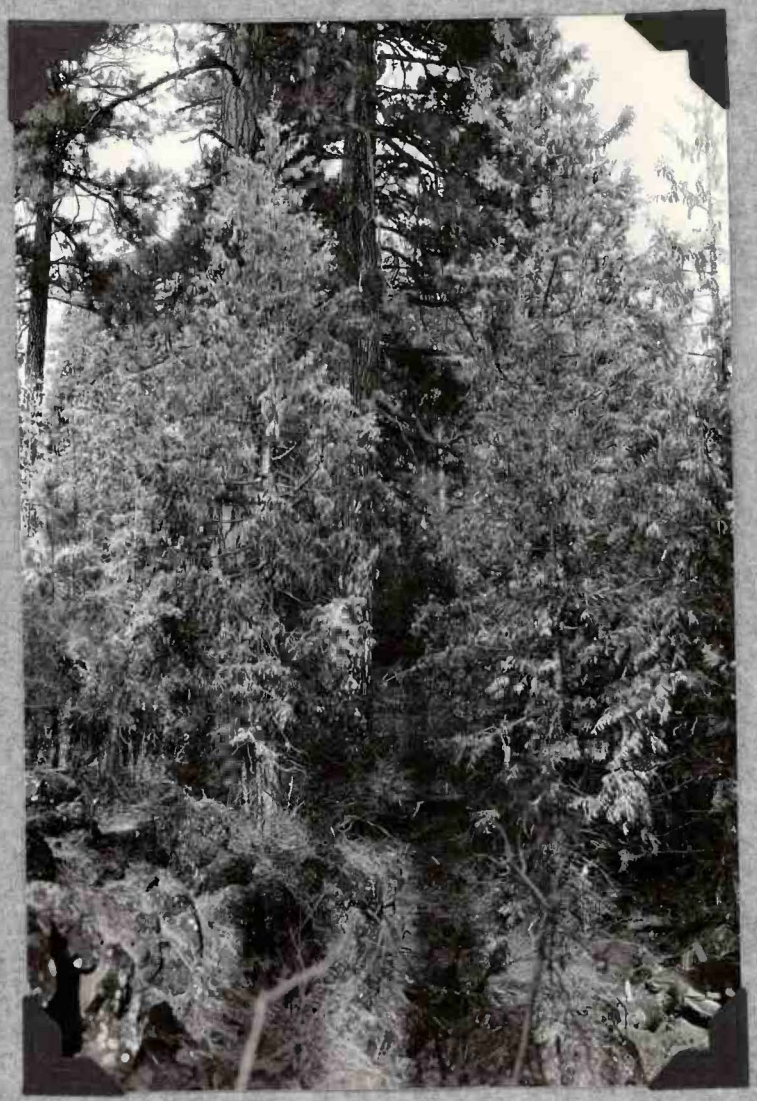


Plate 4

Injury to pole stands of incense cedar in the Buck Creek Unit by Phloeosinus fulgens Sw. The injury caused by the 1932 broods of this insect was severe in this area, and apparently the insects were a primary cause of death. (7493b)

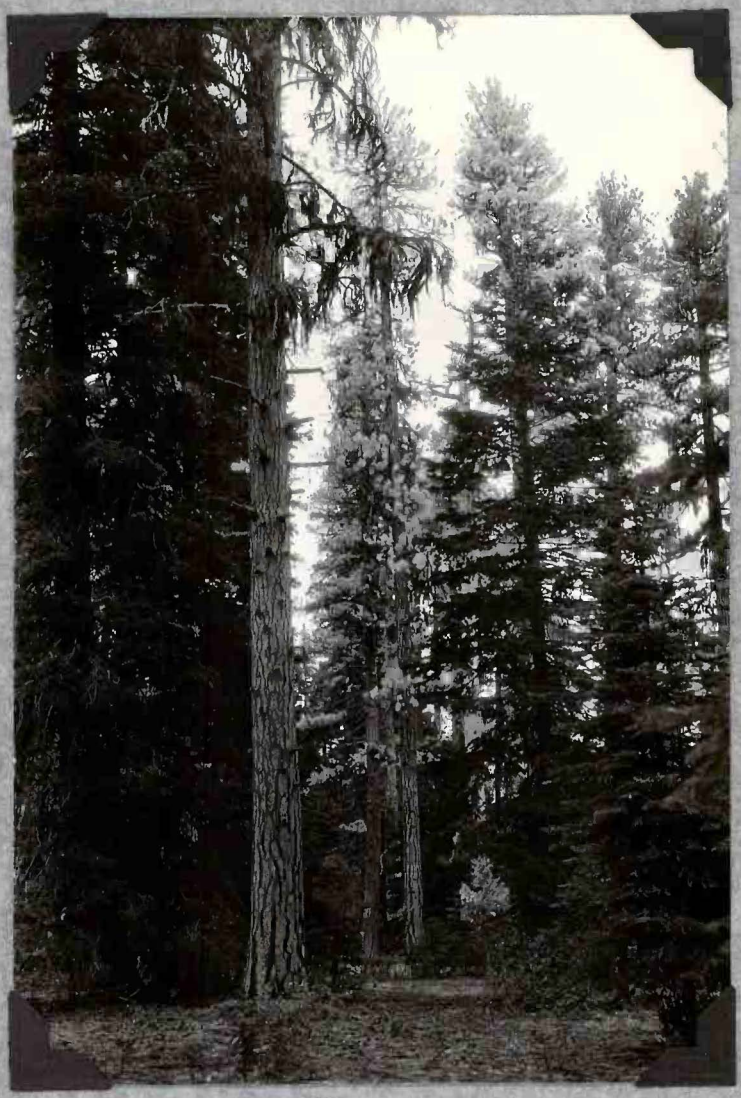


Plate 5

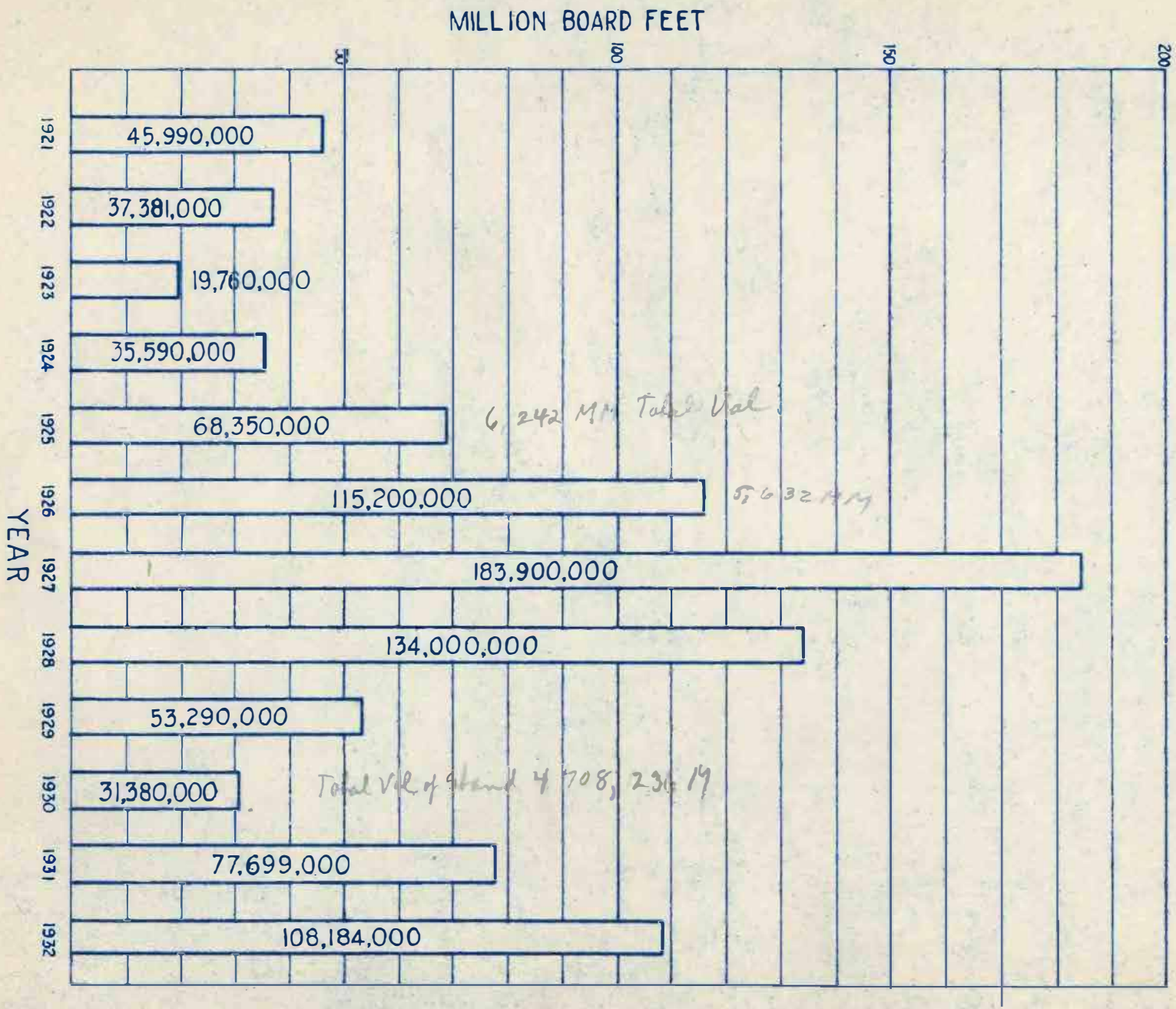
Group of 9 trees infested by 1932 broods of the western pine beetle in the Sugar Hill Unit. Groups such as this are springing up in this area and indicate the epidemic tendencies of the infestation. (7494a)

Plate 6

1931 and 1932 losses in white fir on the north exposures of Sugar Hill, in the Sugar Hill Unit. This infestation, primarily caused by Scolytus [illegible], is, as shown by the photograph, in an epidemic condition. (7494b)

Plate 7

Summary of insect losses in the Happy Camp-Lava Bed area. These losses, which have occurred over the period of years since 1921, are entirely insect-caused, and on the 382,000 acres involved have resulted in a total loss of $2,732,172 worth of lumber if stumpage is considered at $3 per MBM. The unusual similarity of the losses and trends represented by the figures for 1925-26 and 1931-32 is to be noted, as is the marked upward trend of the infestation of the past two years.



SUMMARY OF INSECT LOSSES

HAPPY CAMP-LAVA BED AREA

MODOC NATIONAL FOREST

Plate 7

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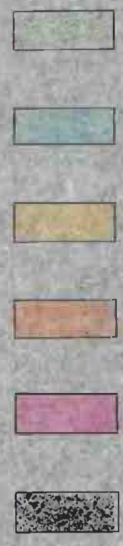
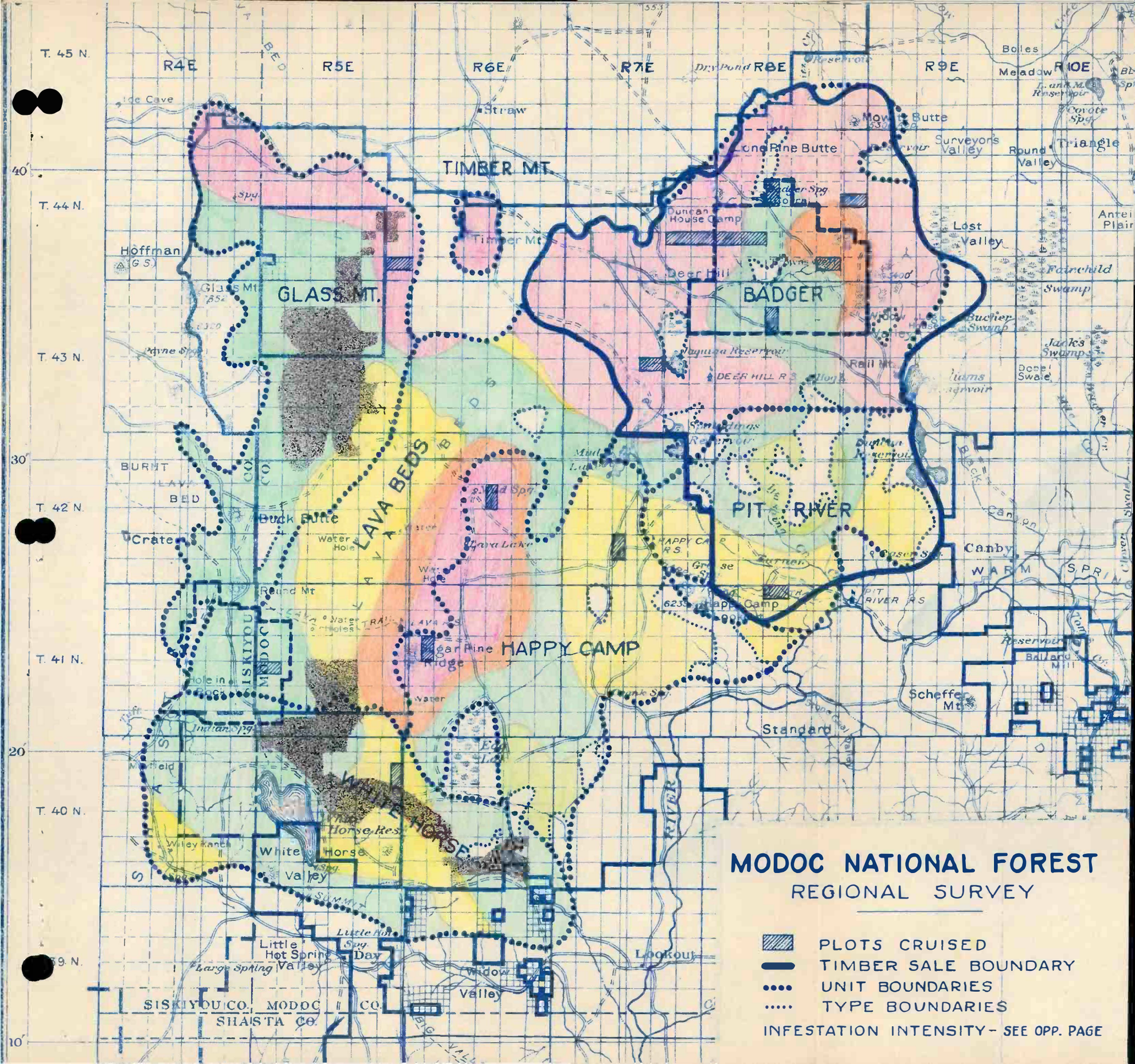
Figure 1

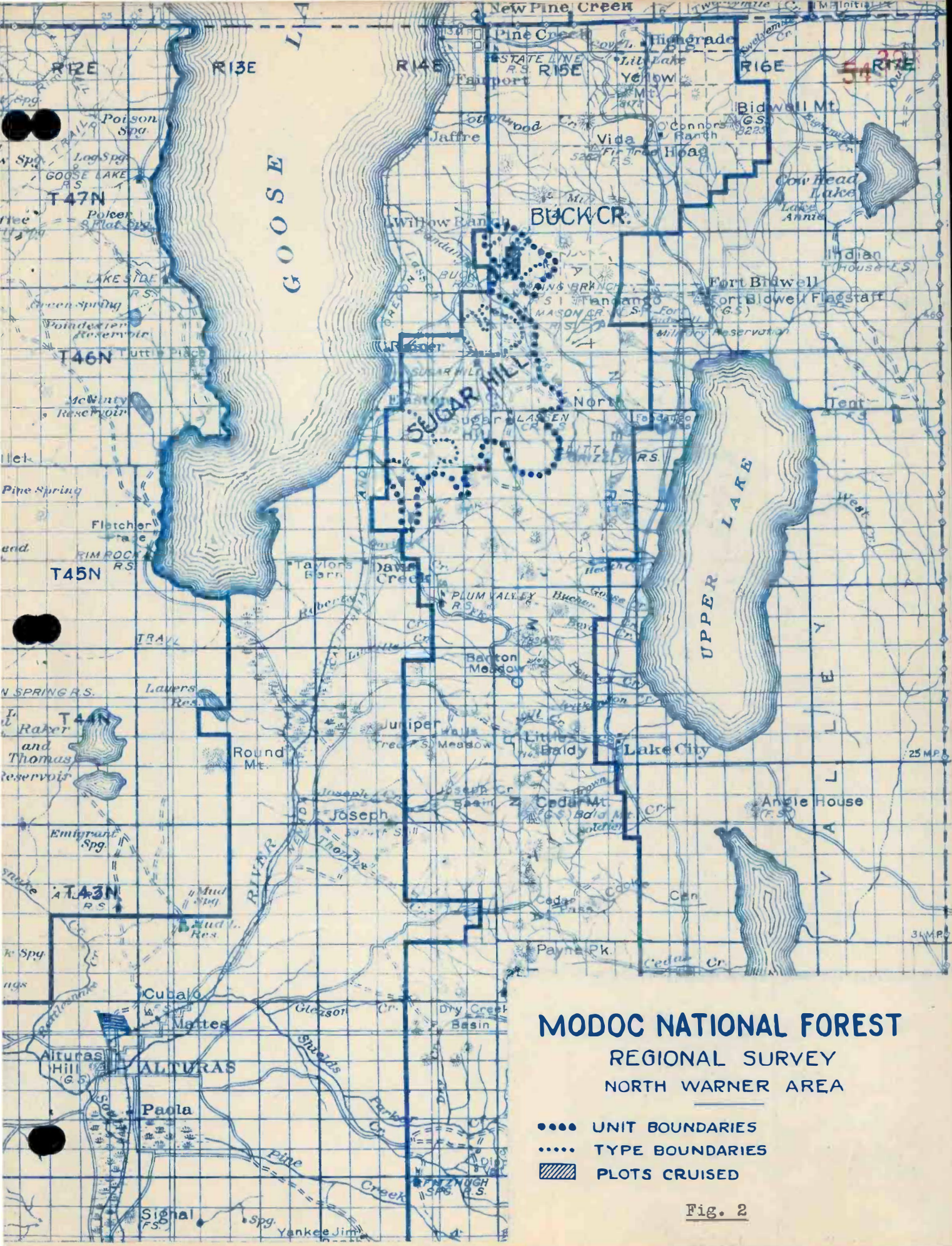
Happy Camp-Lava Bed Area
Modoc National Forest

Legend

Infestation




T. 45 N.
T. 44 N.
T. 43 N.
T. 42 N.
T. 41 N.
T. 40 N.
T. 39 N.
R4E
R5E
R6E
R7E
R8E
R9E
R10E
TIMBER MT.
GLASS MT.
BADGER
PIT RIVER
HAPPY CAMP
LAVA BEDS
WHITE HORSE
Lone Pine Butte
Mow Butte
Triangle
Surveyors Valley
Round Valley
Lost Valley
Fairchild Swamp
Hoffman
Timber Mt.
Deer Hill
Duncan House Camp
Glass Mt.
Buck Butte
Crater
Round Mt.
Water Hole
Lava Lake
Cinder Cone
Indian Spg.
Canby
WARM SPRINGS
Scheffer Mt.
Standard
Ball and Mill
Big Valley
White Horse Valley
Little Hot Spring Valley
Day
Large Spring
Lookout
Widow Valley
SISKIYOU CO.
MODOC CO.
SHASTA CO.
Boles Meadow
Dry Pond
Straw
Ice Cave
Coyote Spg.
Antelope Plain
Jacks Swamp
Dodge Swale
Burnt Lava Bed
Willey Ranch
Modoc National Forest
Regional Survey
Plots Cruised
Timber Sale Boundary
Unit Boundaries
Type Boundaries
Infestation Intensity - See Opp. Page



MODOC NATIONAL FOREST

REGIONAL SURVEY

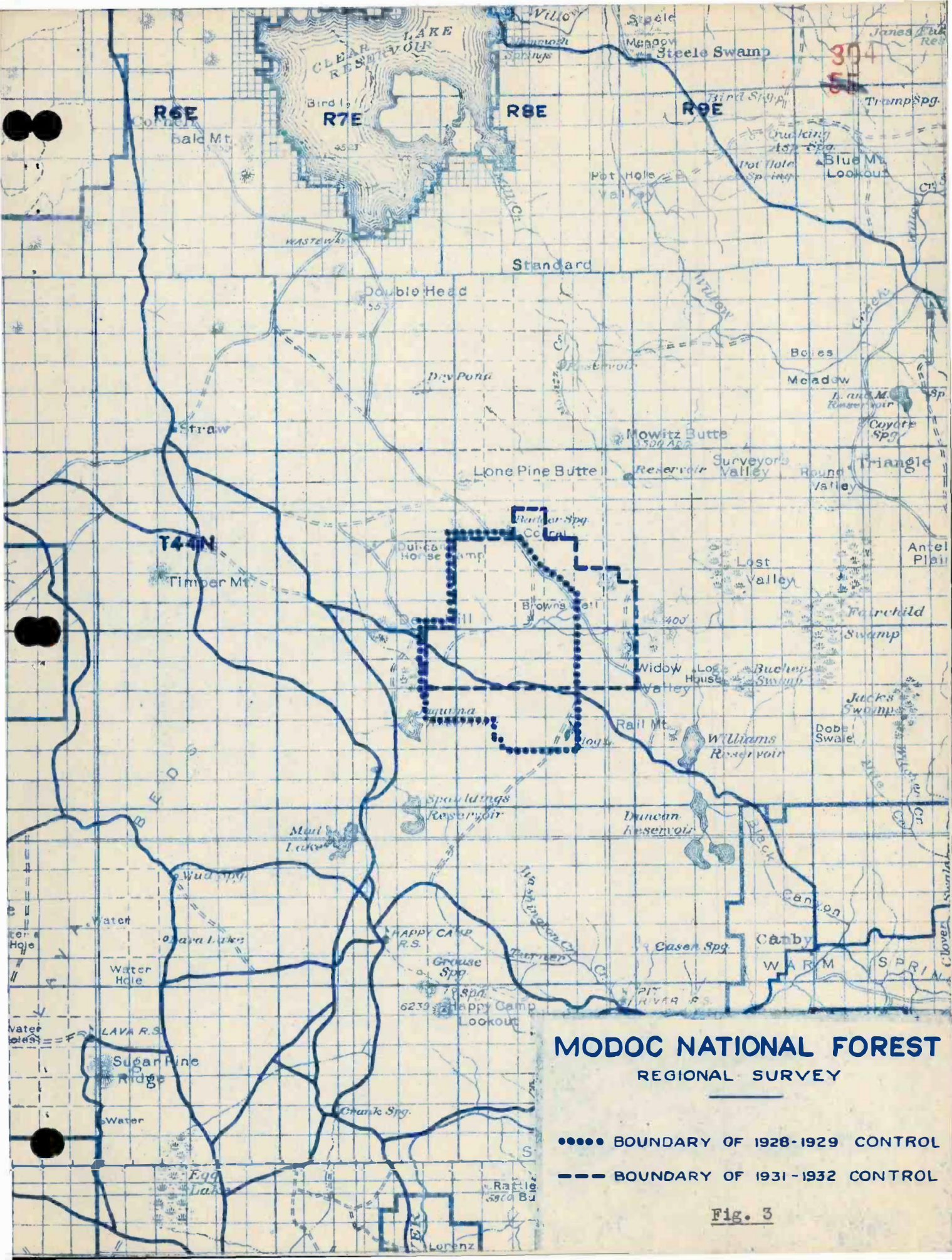
NORTH WARNER AREA

●●●● UNIT BOUNDARIES

····· TYPE BOUNDARIES

▨ PLOTS CRUISED

Fig. 2



MODOC NATIONAL FOREST

REGIONAL SURVEY

••••• BOUNDARY OF 1928-1929 CONTROL

– – – BOUNDARY OF 1931-1932 CONTROL

Fig. 3